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DISCUSSION PAPER: THE APPLICATION OF GEOSTATISTICS TO THE SYDNEY COALFIELD

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DISCUSSION PAPER: THE APPLICATION OF GEOSTATISTICS TO THE SYDNEY COALFIELD

by

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SUMMARY

To assess whether geostatistical techniques can be applied to the problems and conditions existing in the Sydney Coalfield, a three day visit was made to the Mine Evaluation Group (MEG), MRL Ottawa, by CBCRL personnel. As a test case, data from the NOVACO Point Aconi open pit site was input to the Mine Evaluation Group's GEM (Geostatistical Evaluation of Mines) suite of programmes. This report describes the sequence of operations performed on the Point Aconi data when using the GEM system programmes. Examples of semi-variogram analysis and kriging are given, although a detailed evaluation of the site was not possible due to a lack of time.

Finally, the direction of future research programmes regarding the use of geostatistics in the Sydney Coalfield are discussed. In particular, it is suggested that a dual purpose programme be established to undertake both the resource/reserve evaluation of mineral areas and the use of geostatistics in the field of strata mechanics.

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DOCUMENT DE TRAVAIL: L'APPLICATION DES MÉTHODES GÉOSTATISTIQUES AU GISEMENT DE CHARBON DE SIDNEY

par

T.R.C. Aston*, D. MacNeil** et C. White***

SOMMAIRE

Le personnel du LRCCB a effectué une visite de trois jours auprès du Groupe d'évaluation des mines, aux LRM d'Ottawa, dans le but d'évaluer la possibilité d'appliquer des techniques géostatistiques aux problèmes et conditions rencontrés dans le gisement de charbon de Sidney. On a procédé à un essai en introduisant des données provenant de la mine à ciel ouvert Point Aconi de NOVACO dans la série de programme GEM (évaluation géostatistique des mines) du Groupe d'évaluation des mines. Le présent rapport décrit la séquence d'opérations effectuées avec les données de Point Aconi lorsqu'on utilise les programmes du système GEM. Des exemples d'analyse de semi-variogrammes et de "kriging" sont donnés, bien qu'il ait été impossible de procéder à une évaluation détaillée du site en raison du manque de temps.

Enfin, on examine la direction à donner aux futurs programmes de recherche en ce qui concerne l'utilisation des méthodes géostatistiques. On suggère en particulier d'élaborer un programme à deux objectifs pour d'une part évaluer les ressources et les réserves des zones minières et d'autre part utiliser les méthodes géostatistiques dans le domaine de la mécanique des strates.

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CONTENTS

	Page
SUMMARY	i
SOMMAIRE	ii
INTRODUCTION	1
GEOSTATISTICS WITHIN CANMET	2
GEOSTATISTICS AND THE SYDNEY COALFIELD	2
USE OF THE MEG SYSTEM	4
Data preparation	4
Variogram analysis	7
Kriging estimation	10
Final resource/reserve evaluation	10
DISCUSSION	12
CONCLUSION	13
ACKNOWLEDGMENTS	14
REFERENCES	14
APPENDIX A	15
APPENDIX B	17

TABLES

No.		
1.	Collated borehole data, Main seam, NOVACO Point Aconi Site	5

ILLUSTRATIONS

Fig.		
1.	CADD and GEM program description and evaluation methodology (after Sabourin (2))	3
2.	Schematic output from program 3000 showing borehole locations in relation to the pit limits, Point Aconi Site	6

Fig.		Page
3.	Initial semi-variogram of net seam thickness (metres), Point Aconi Site	8
4.	Refined semi-variogram of net seam thickness (metres), Point Aconi Site	9
5.	Schematic representation of kriging process undertaken for net seam thickness (metres), Point Aconi Site	11

INTRODUCTION

At a meeting held on January 13, 1983 between members of the CBCRL Strata Mechanics group and personnel from the N.S. Dept. of Mines and Energy (NSDME), NOVACO and CBDC the application of geostatistical techniques to the Sydney Coalfield were raised. Subsequent discussions between CBCRL, NOVACO and NSDME revealed considerable interest in the use of geostatistics* for:

1) Determining in situ coal resources once the initial exploratory drilling phase of a program is completed.
2) Determining the mineable reserves of an area prior to and during extraction.

In both cases, it was felt that geostatistics could provide the most economic drill hole spacings and borehole locations for subsequent drilling programmes.

In addition to the NSDME and NOVACO, considerable interest also lies within CBCRL for the use of geostatistical techniques with ongoing strata mechanics research programmes. Geostatistics can be used on any data set where a continuous measure is made on a sample at a particular location in either space or time, or where a sample is expected to be affected by both its position and relation to neighboring samples. With this in mind almost any parameter can be analyzed; seam or strata thickness, ash or sulphur content, porosity, permeability, elevation, density, rainfall, temperature, fracture length or whatever! (1).

It is suggested that apart from work on reserve evaluation, geotechnical and/or hydrochemical data collected within the Sydney Coalfield could be analyzed. Similarly, the analysis of dust and gas data could also be integrated into any proposed research program at a later stage.

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*In this context geostatistics is referred to as the 'Theory of Regionalized Variables' or a method for producing the best estimate of an unknown value at some location within a mineral body using the technique of kriging (1).

GEOSTATISTICS WITHIN CANMET

In 1974, the Mine Evaluation Group (MEG) was created within the Mining Research Laboratories division of CANMET. The object of this group which comprises professional geologists, mining engineers, geostatisticians and programmers was to evaluate the Reasonably Assured Uranium Resources of Canada.

Since 1975, two suites of computer programs have been developed by MEG. The CADD system (Coding and Analysis of Drill hole data) is used to code, edit and prepare the basic drill hole data which is subsequently used to evaluate the reserves. The GEM system (Geostatistical Evaluation of Mines) comprises a suite of programmes which allow variogram analysis and kriging estimations to be undertaken. A brief description of these programmes along with their evaluation methodology is given in Figure 1, (2).

Although these systems were originally developed for the evaluation of uranium reserves, they have also been used to undertake a reserve evaluation of the Southern Saskatchewan lignite deposits (3).

The CADD and GEM programmes are documented in 25 CANMET divisional reports, Appendix A.

GEOSTATISTICS AND THE SYDNEY COALFIELD

Since a suite of geostatistical programmes and the expertize to use them were already present within CANMET, it was considered that an opportunity existed for:

1) CBCRL personnel to familiarize themselves with the methodology of the GEM system.
2) Input a series of local test data and assess whether geostatistical techniques could be applied to the problems and conditions encountered within the Sydney Coalfield.

DESCRIPTION OF PROGRAMS			PRO-GRAM NAME	EVALUATION METHODOLOGY							
				GEOMETRIC METHODS				MOVING AVERAGE AND DISTANCE WEIGHTING METHODS		GEO-STATISTICAL METHODS	
				SECTION		POLYGON					
TABULAR DEPOSITS		2-D		2D	3D	2D	3D	2D	3D	2D	3D
ALL DEPOSITS		3-D									
CADD	DATA PREPARATION		1000 1600	☐	☐	☐	☐	☐	☐	☐	☐
GEM SYSTEM	GROUP NO. 1	ECONOMICAL INTERSECTIONS	100	☐	☐	☐		☐		☐	
		GROUPING ECONOMICAL INTERSECTIONS	2010			☐		☐		☐	
		GRAPHICAL PROJECTION OF DRILLHOLES ON SECTION OR PLAN	3000	☐	☐	☐	☐				
	GROUP NO. 2	EQUAL LENGTH SEGMENTS ALONG DRILLHOLES	2040				☐		☐		☐
		GROUPING EQUAL LENGTH SEGMENTS WITHIN UNIT BLOCKS	2050					☐	☐		☐
		EVALUATING BLOCK GRADE USING MOVING AVERAGE OR I.D.	2055					☐	☐		
	GROUP NO. 3	BASIC STATISTICS-HISTOGRAMS DISTRIBUTION TESTS-REGRESSIONS	2100							☐	☐
		VARIOGRAMS AND TRENDS COMPUTED BY THE SECTORS METHOD	2200							☐	☐
		VARIOGRAMS AND TRENDS COMPUTED BY THE BLOCKING METHOD	2250							☐	☐
		TREND AND GENERALIZED COVARIANCE ANALYSIS	2350							☐	
	GROUP NO. 4	NORMAL-LOGNORMAL-CLUSTER-UNIVERSAL POINT-BLOCK-POLYGON-KRIGING	2300							☐	☐
		NORMAL-UNIVERSAL-POINT-BLOCK KRIGING	2350							☐	
		TABLES OF RESERVES INVENTORY	2400							☐	☐
		ISOCURVES TRACING	2500			☐	☐	☐	☐	☐	☐

Figure 1 CADD and GEM Program Description and Evaluation Methodology (after Sabourin (2))

As a test case it was decided to use data from the NOVACO Open Pit at Point Aconi with a view to determining whether geostatistics could eventually be used to assess the mineable reserves. Arrangements were subsequently made between CBCRL and MEG (MRL Ottawa), and a three day period, May 30th to June 1st, set aside for coding and manipulating the NOVACO data.

USE OF THE MEG SYSTEM

Use of the MEG system can be divided into four main stages:

1) Data Preparation
2) Variogram Analysis
3) Kriging Estimation
4) Final Resource/Reserve Evaluation

1) DATA PREPARATION

Choice of the Point Aconi Open Pit site was determined by two main factors:

1) A relatively small number of geological boreholes (32) located across the site.
2) A comprehensive data set existed for each of the 32 boreholes.

Prior to visiting MEG, personnel from both NOVACO and the NSDME undertook the task of collating and tabulating all the available Point Aconi data. A list of the parameters tabulated and the additional data collected is given in Table 1.

During discussions with MEG personnel, it was decided that when dealing with coal resources similar to those at Point Aconi it was unnecessary to use the CADD suite of programmes. The Point Aconi data was therefore coded in a format suitable for input to Program 3000 (Borehole identification numbers and coordinates based on the Nova Scotia MTM system). Figure 2 shows a schematic output from Program 3000 giving the borehole locations in relation to the pit limits.

NOVACO OPEN PIT BOREHOLE DATA (MAIN SEAM)

Drill Hole Number

Total Depth of Borehole (m)

Depth of Coal (m) - Rise and Pavement

Coal Thickness (m)

Seam Elevation (m) - Rise and Pavement

Waste Thickness (m) - Overburden and Rock

Coal Parting Separation (m)

Borehole Collar Elevation (m)

Ash %

Sulphur %

CU's BTU/LB

Provincial Coordinates of Boreholes

Local Coordinates of Boreholes

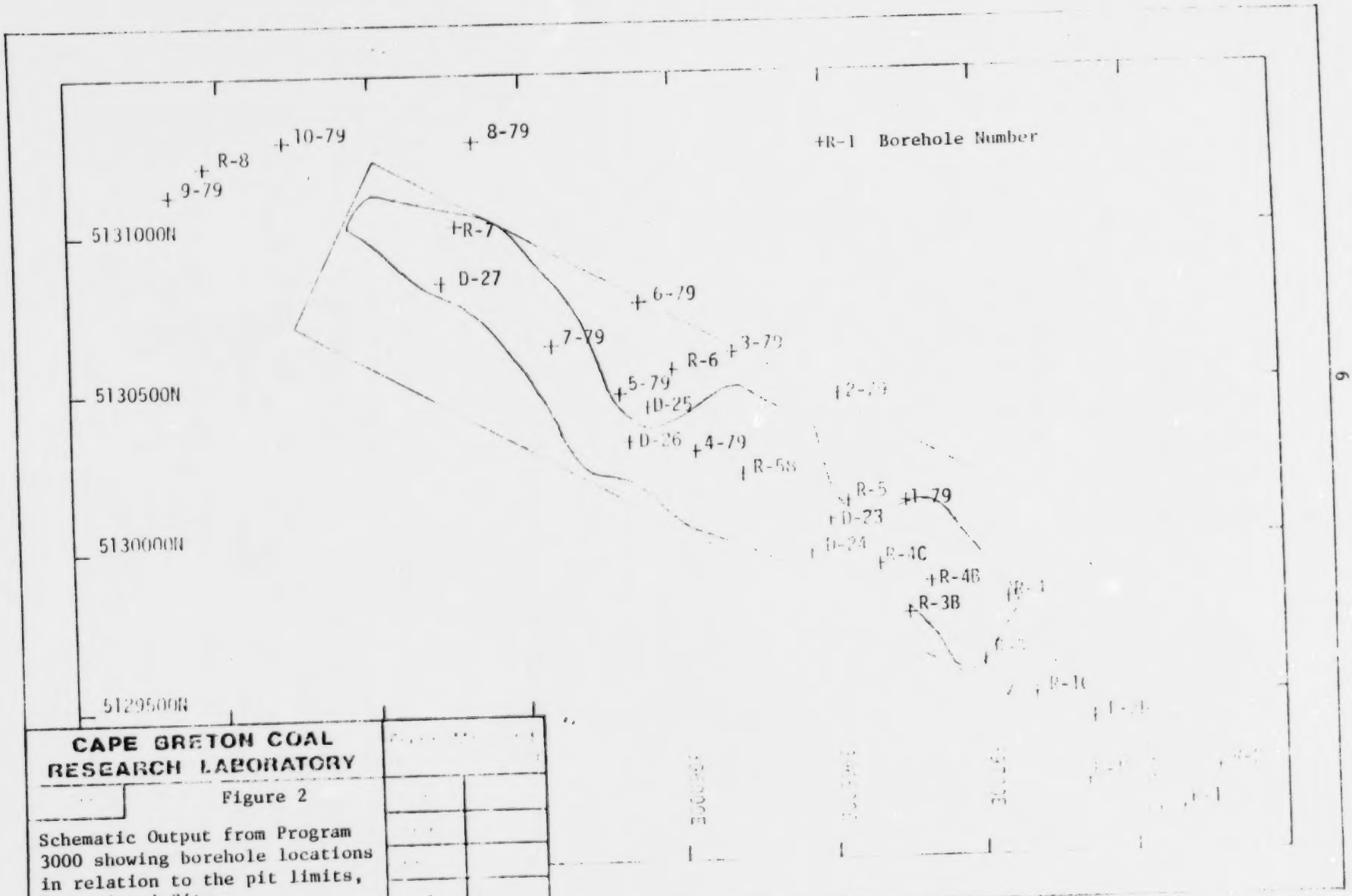
Borehole Geological Logs and Sections

Borehole Geophysical Logs (where available)

Local Base Line Coordinates

Site Plan

Table 1 Collated Borehole Data, Main Seam, NOVACO Point Aconi Site



CAPE BRETON COAL RESEARCH LABORATORY

Figure 2

Schematic Output from Program 3000 showing borehole locations in relation to the pit limits, Point Aconi Site.

Originally the Point Aconi data was tabulated with a view to direct input to the GEM system programmes. However, after initial discussions it was soon found that in order to undertake a comprehensive reserve evaluation it would be necessary to manipulate the data and calculate a number of additional parameters:

Seam thickness (no parting, no mining loss) }
Seam thickness (with parting, with mining loss) } Mineability Criteria
Seam thickness (with parting, no mining loss) }
Sulphur Content - Weighted Accumulation (% x Seam Thickness)
Ash Content - Weighted Accumulation (% x Seam Thickness)

Once this operation was completed, had time permitted, the ensuing results would have been input to Program 2100 in order to establish basic statistics for each of the data sets involved i.e. Histograms, Distribution Tests and Regression Coefficients.

2) Variogram Analysis

Due to limitations on the amount of time available only a basic net coal thickness was input to Program 2200, which produces a semi-variogram and associated trends computed by the sector method.

Figure 3 shows an initial semi-variogram for seam thickness in schematic form. In essence, one of the major tasks in geostatistics is to fit with a high degree of confidence a theoretical semi-variogram model to the actual data being analyzed. In the case of Figure 3, the actual/theoretical semi-variogram fit is relatively poor. The next stage in the process is therefore to refine the original data set and establish a better theoretical to actual fit. This can be achieved in one of two ways:

1) Examine the actual semi-variogram and basic statistical data produced by Program 2100 and eliminate any anomalous points which lie outside the 'normal range'. The refined data is then re-submitted to Program 2200 and the ensuing semi-variograms examined for a better actual/theoretical fit. Figure 4 shows a refined semi-variogram fit carried out for the net seam thickness data.

ASV - Actual Semi-Variogram

TSV - Theoretical Semi-Variogram

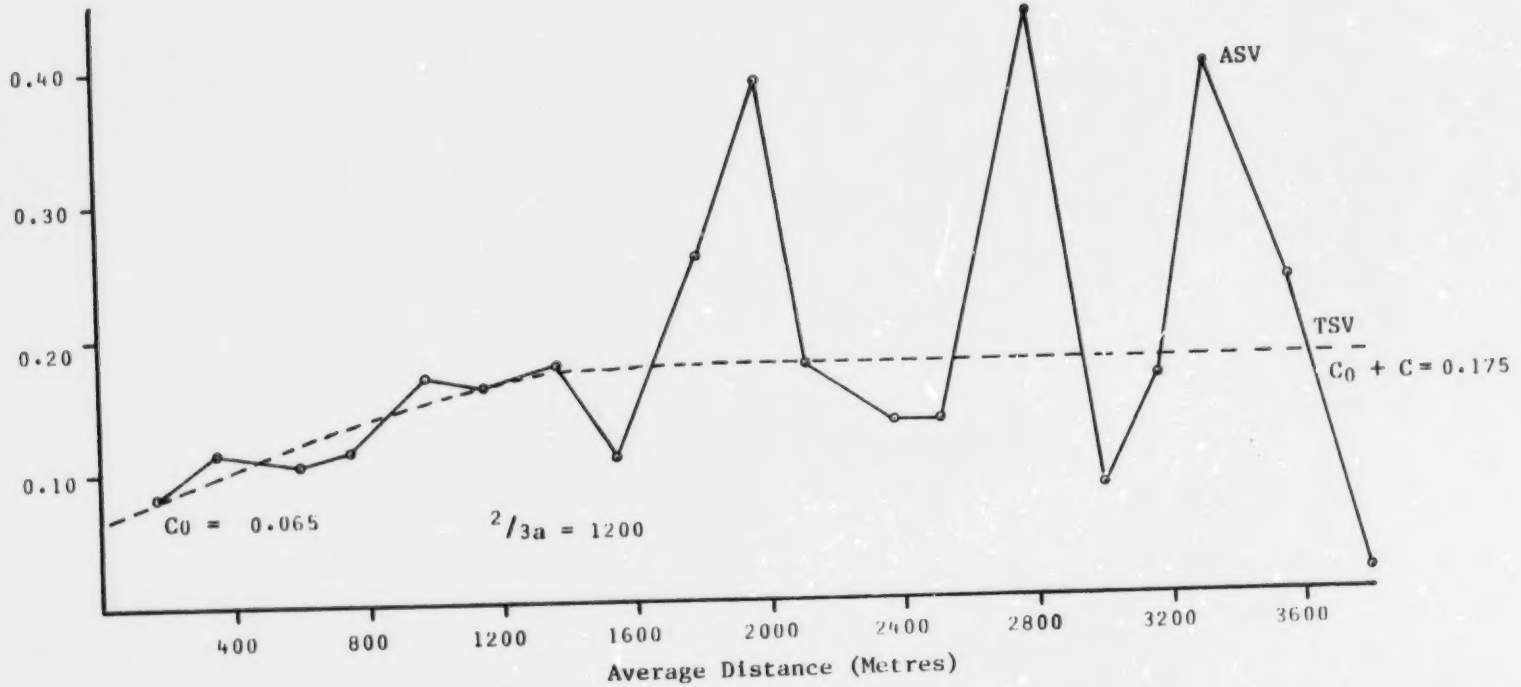


Figure 3 Initial Semi-Variogram of Net Seam Thickness, Point Aconi Site

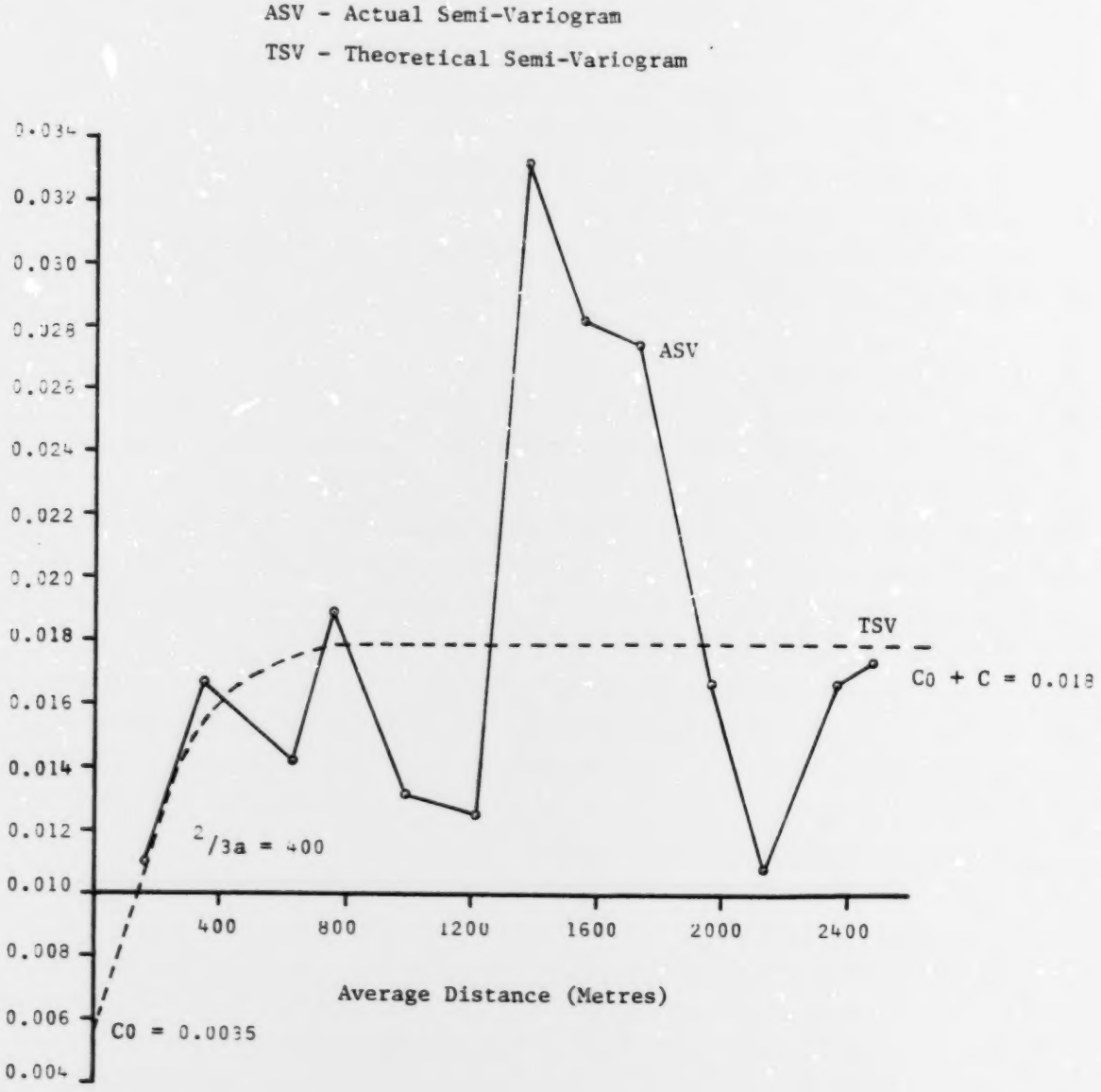


Figure 4 Refined Semi-Variogram of Net Seam Thickness (Metres), Point Aconi Site

2) Examine the original data set and determine whether it has been misinterpreted. In the case of the Point Aconi data, the actual coal seam is found to split across the site. It may therefore be necessary to analyze the seam as two entirely separate seams rather than one. Additional refinement of the actual semi-variograms may also be necessary during the latter stages of this option.

Usually, the type of refinement described in option 1 would be tried before progressing to option 2. Similarly, the analysis and interpretation of semi-variograms is both time consuming and dependent on the experience of the operator.

3) Kriging Estimation

Once the semi-variogram has been refined to the satisfaction of the interpreter, the data is input to Program 2300 along with the values of Co + C, Co and 2/3a, in this case obtained from Figure 3. The process of kriging calculates the 'best linear unbiased estimator' based on the known sample points within a grid of blocks of predetermined size. In the case of the Point Aconi site, a grid of 12 x 27 blocks were superimposed over the area, each with a 'ground size' of 48 by 96 m.

Figure 5 shows a schematic diagram of the kriging process undertaken for the Point Aconi net seam thickness, determined from the data given in Figure 3. The pit outline is also delineated.

4) Final Resource/Reserve Estimation

To determine the final resource/reserve evaluation for a site, semi-variogram analysis and kriging has to be undertaken for each of the parameters available. In the case of Point Aconi, this would involve the analysis of at least 8 parameters based on Table 1, provided the coal horizon was treated as a single seam. If however the coal horizon is treated as two separate seams then at least 16 parameters would require analysis. (At Point Aconi the seam splits across the site)

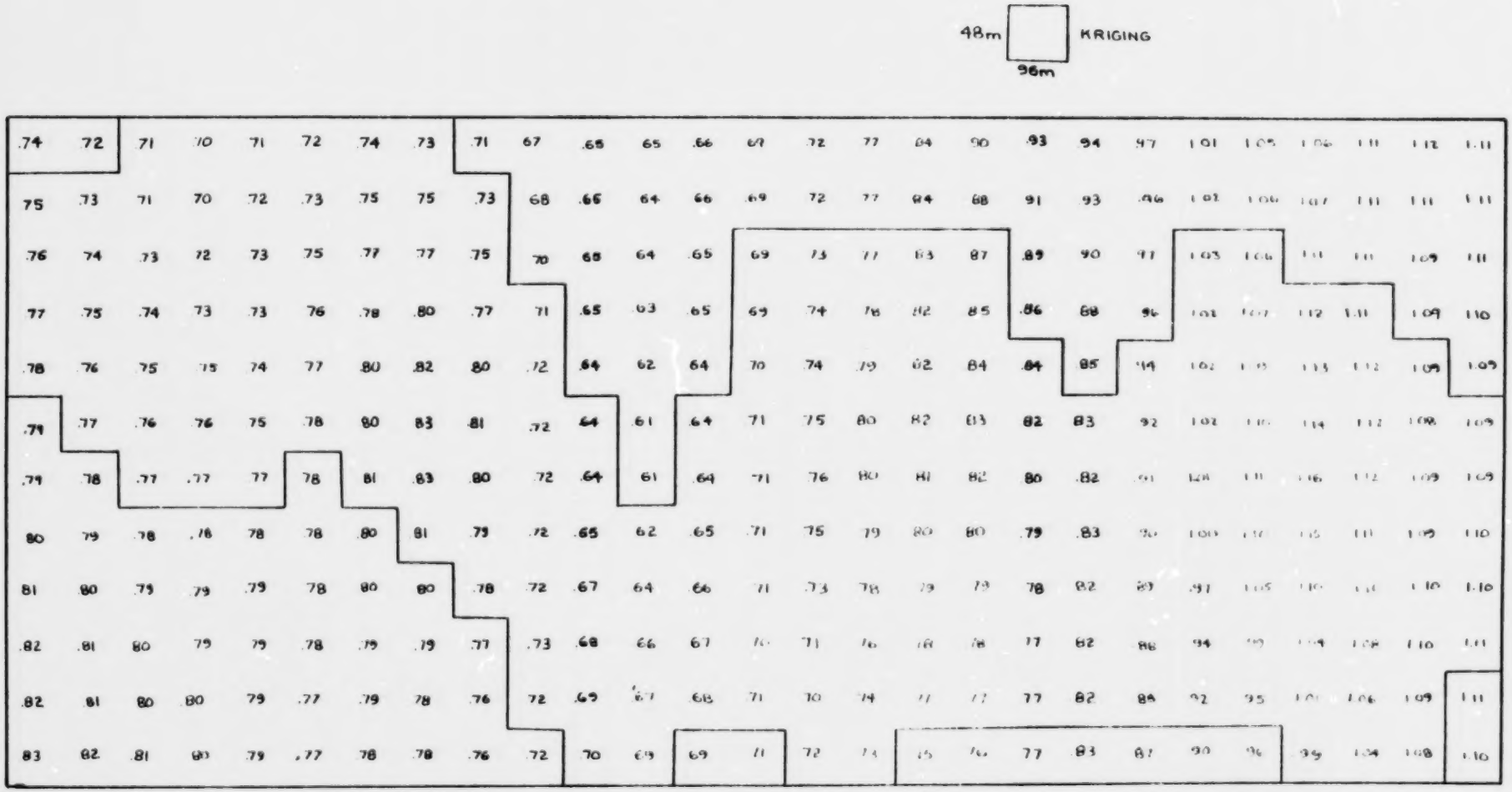


Figure 5 Schematic representation of Kriging Process undertaken for Net Seam Thickness (Metres), Point Aconi Site

Once this procedure has been completed the final data is input to Programmes 2400 and 2500. Program 2400 produces a tabulated inventory of reserves while 2500 produces isocurve maps of the area for each of the parameters analyzed. Unfortunately, due to time constraints imposed by the three day period, Programmes 2400 and 2500 were not used.

DISCUSSION

During the initial stages of the exercise, a number of questions were raised concerning both missing data and aspects of the coal workings which required further clarification. To save time during any future work, the following list of questions are given:

1. Are the pit limits delineated by the top or bottom of the highwall?
2. What is the slope of the highwall?
3. What area of sterilized coal was left around any roads?
4. What is the coal density (wet or dry)?
5. What is the average production area for one month?
6. What are the coal loss and/or dilution factors?

In general, a majority of the questions are aimed at trying to establish limits for the pit reserves and any areas of coal, within these limits, which may be effectively sterilized.

It appears from work done to date that geostatistics could be successfully used in the Sydney Coalfield for resource/reserve evaluation. Similarly, many potential applications exist within the field of strata mechanics. With this latter consideration in mind, it is hoped during the autumn to initiate a program, in conjunction with CBDC, to obtain sufficient rock property data to allow a geostatistical evaluation of the strata surrounding a longwall panel. A brief description of this proposed program is given in Appendix B.

Future work involving the use of geostatistics within the Sydney Coalfield could therefore be summarized as follows:

1) An initial comprehensive evaluation of the NOVACO Point Aconi data, followed by the development of an ongoing program to assess further resources/ reserves within the coalfield.
2) The initiation of data collection schemes allowing the geostatistical analysis of strata mechanics problems encountered within the coalfield.

Ideally both these program segments should be run concurrently.

Unfortunately as with any program, certain problems can be identified at an early stage. With regard to any geostatistical work proposed for the Sydney Coalfield, the following problems can be identified:

1) A lack of personnel qualified in the use of geostatistics to undertake the detailed evaluation work.
2) A current lack of computer facilities within CBCRL, although all the necessary facilities exist within MEG (MRL, Ottawa).

CONCLUSION

Geostatistical techniques offer a powerful tool in solving some of the problems currently being encountered in the Sydney Coalfield. Considerable interest lies within CBCRL, the NSDME and NOVACO to develop these techniques further. Similarly, the use of these techniques by the NSDME in areas outside the Sydney Coalfield has also been expressed. It is therefore proposed that initially, a limited program be established between CBCRL, MRL, NSDME, NOVACO and CBDC in order to evaluate the use of geostatistical techniques in the Sydney Coalfield.

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REFERENCES

1. Clark, I. "Practical Geostatistics"; Applied Science Publishers Ltd., London, 1979.

2. Sabourin, R. "Computer Use in Resource Evaluation - CANMET's System for Mineral Reserve Evaluation"; Division Report ERP/MRL 83-1(J); CANMET, Energy, Mines and Resources Canada; 1983.

3. Sabourin, R. and Boyle, R. "Methodological Development for a Reserve Inventory of Coal in Southern Saskatchewan"; Division Report ERP/MRL 82-28(TR); CANMET, Energy, Mines and Resources Canada; 1982.

APPENDIX A

ERP/MRL 83-1 (J)
CANMET's systems for mineral reserve evaluation;
R. Sabourin;
22 pp.
MICROMEDIA ORDER NO.

ERP/MRL 82-63 (TR)
Guide for coding drill-hole data from uranium deposits, version 3;
R. Sabourin;
41 pp.
MICROMEDIA ORDER NO.

ERP/MRL 82-89 (TR)
Program MEG 0401 user's guide - CADD system - CANMET systems for mineral reserve evaluation - version I;
Boyle R;
21 pp.
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ERP/MRL 83-90 (TR)
Program MEG 0402 user's guide - CADD system - CANMET systems for mineral reserve evaluation - version I;
Boyle R;
18 pp.
MICROMEDIA ORDER NO.

ERP/MRL 82-91 (TR)
Program MEG 0403 user's guide - CADD system - CANMET systems for mineral reserve evaluation - version I;
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R. Boyle and R.L. Sabourin;
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R.L. Sabourin;
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MICROMEDIA ORDER NO.

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Program MEG 2055 user's guide - GEM system - CANMET systems for mineral reserve evaluation - version I;
R. Boyle and R.L. Sabourin;
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MICROMEDIA ORDER NO.

ERP/MRL 82-107 (TR)
Program MEG 2100 user's guide - GEM system - CANMET systems for mineral reserve evaluation evaluation - version I;
R.L. Sabourin;
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ERP/MRL 82-108 (TR)
Program MEG 2200 user's guide - GEM system - CANMET systems for mineral reserve evaluation - version I;
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26 pp.
MICROMEDIA ORDER NO.

ERP/MRL 82-111 (TR)
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R.L. Sabourin;
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ERP/MRL 82-112 (TR)
Program MEG 2400 user's guide - GEM system - CANMET systems for mineral reserve evaluation - version I;
R.L. Sabourin;
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MICROMEDIA ORDER NO.

ERP/MRL 82-113 (TR)
Program MEG 2560 user's guide - GEM system - CANMET systems for mineral reserve evaluation - version I;
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APPENDIX B

PROPOSAL FOR EVALUATING STRATA PROPERTIES AROUND A LONGWALL PANEL USING GEOSTATISTICAL TECHNIQUES

Introduction

The object of the investigation is to obtain sufficient rock property data to allow the geostatistical evaluation of strata surrounding a longwall panel.

Implementation

In essence, the field component of the program involves collecting samples of roof strata, at say 5 m intervals, along both gateroads and the faceline of a longwall panel. Sufficient samples are collected at each sampling point to allow at least 10 tests using the NCB Cone Indentor. The samples are collected underground, while the Indentor testing and geological classification are carried out in the laboratory.

To evaluate strata surrounding an advancing longwall face, it would be necessary to:

1) Sample the full length of an adjoining panel gateroad.
2) Sample initially both gateroads and the faceline of the panel to be monitored.
3) Sample periodically the new faceline and additional gateroad portions.

Figure B1 shows the proposed sampling program for an advancing longwall panel.

To evaluate strata surrounding a retreating longwall face, it would be necessary to:

1) Sample the full length of both gateroads and the face.
2) Sample periodically the new faceline position.

Figure B2 shows the proposed sampling program for a retreating longwall panel.

Objective

Once sufficient data has been obtained geostatistics can be used, via kriging estimation, to predict strata properties ahead of the faceline. As more data becomes available, the predictions can be refined and a greater degree of confidence placed on the type of strata likely to be encountered ahead of a faceline. In this manner, it may be possible to predict areas of weak ground ahead of a faceline and develop a series of theoretical semi-variograms for use either in a particular colliery or area of the coalfield, with respect to rock properties in proximity to a particular seam.

x - Sampling Point

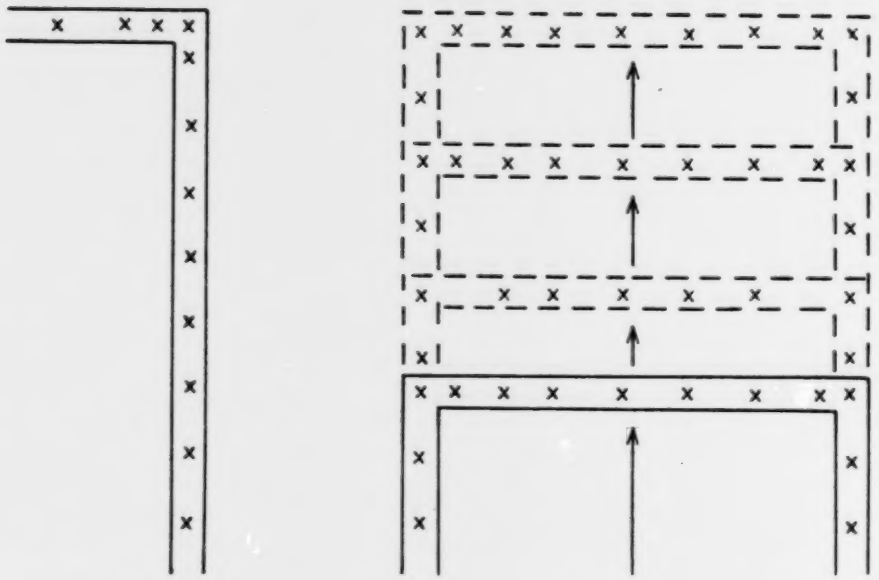

Figure B1 Proposed Sampling Program for an Advancing Longwall Face

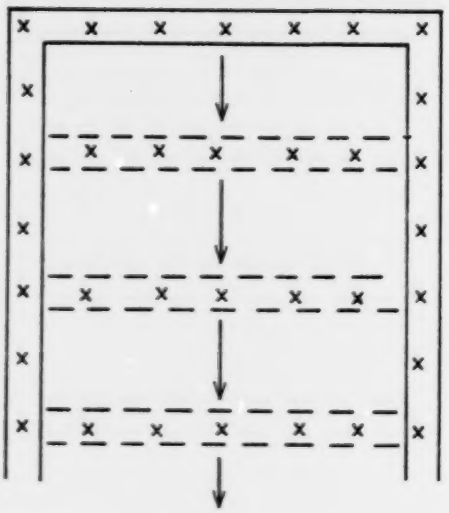

Figure B2 Proposed Sampling Program for a Retreating Longwall Face